(14) can be present in the entire capillary (13B); similarly, less trapping material (14) could be present than that shown in Figure 62 because the positively-charged reaction products generally accumulate within a very small portion of the bottom of the capillary (13B). The amount of trapping material need only be sufficient to make contact with the reaction solution (11) and have the capacity to collect the reaction products. When capillary 13B is not completely filled with the trapping material, the remaining space is filled with any conductive material (15); suitable conductive materials are discussed below.

By comparison, the capillary (13A) connected to the positive electrode of the power supply 20 may be filled with any conductive material (15; indicated by the hatched lines in Figure 62). This may be the sample reaction buffer (*e.g.*, 10 mM MOPS, pH 7.5 with 150 mM LiCl, 4 mM $MnCl_2$), a standard electrophoresis buffer (*e.g.*, 45 mM Tris-Borate, pH 8.3, 1.4 mM EDTA), or the reaction solution (11) itself. The conductive material (15) is frequently a liquid, but a semi-solid material (*e.g.*, a gel) or other suitable material might be easier to use and is within the scope of the present invention. Moreover, that trapping material used in the other capillary (*i.e.*, capillary 13B) may also be used as the conductive material. Conversely, it should be noted that the same conductive material used in the capillary (13A) attached to the positive electrode may also be used in capillary 13B to fill the space above the region containing the trapping material (14) (*see* Figure 62).

The top end of each of the capillaries (13A and 13B) is connected to the appropriate electrode of the power supply (20) by electrode wire (18) or other suitable material. Fine platinum wire (*e.g.*, 0.1 to 0.4 mm, Aesar Johnson Matthey, Ward Hill, MA) is commonly used as conductive wire because it does not corrode under electrophoresis conditions. The electrode wire (18) can be attached to the capillaries (13A and 13B) by a nonconductive adhesive (not shown), such as the silicone adhesives that are commonly sold in hardware stores for sealing plumbing fixtures. If the capillaries are constructed of a flexible material, the electrode wire (18) can be secured with a small hose clamp or constricting wire (not shown) to compress the

opening of the capillaries around the electrode wire. If the conducting material (15) is a gel, an electrode wire (18) can be embedded directly in the gel within the capillary.

The cleavage reaction is assembled in the reaction tube (10) and allowed to proceed therein as described in proceeding examples (*e.g.*, Examples 22-23). Though not limited to any particular volume of reaction solution (11), a preferred volume is less than 10 ml and more preferably less than 0.1 ml. The volume need only be sufficient to permit contact with both capillaries. After the cleavage reaction is completed, an electric field is applied to the capillaries by turning on the power source (20). As a result, the positively-charged products generated in the course of the invader-directed cleavage reaction which employs an oligonucleotide, which when cleaved, generates a positively charged fragment (described in Ex. 23) but when uncleaved bears a net negative charge, migrate to the negative capillary, where their migration is slowed or stopped by the trapping material (14), and the negatively-charged uncut and thermally degraded probe molecules migrate toward the positive electrode. Through the use of this or a similar device, the positively-charged products of the invasive cleavage reaction are separated from the other material (*i.e.*, uncut and thermally degraded probe) and concentrated from a large volume. Concentration of the product in a small amount of trapping material (14) allows for simplicity of detection, with a much higher signal-to-noise ratio than possible with detection in the original reaction volume. Because the concentrated product is labelled with a detectable moiety like a fluorescent dye, a commercially-available fluorescent plate reader (not shown) can be used to ascertain the amount of product. Suitable plate readers include both top and bottom laser readers. Capillary 13B can be positioned with the reaction tube (10) at any desired position so as to accommodate use with either a top or a bottom plate reading device.

In the alternative embodiment of the present invention depicted in Figure 63, the procedure described above is accomplished by utilizing only a single capillary (13B). The capillary (13B) contains the trapping material (14) described above and is connected to an electrode wire (18), which in turn is attached to the negative electrode of a power supply (20). The reaction tube (10) has an electrode (25) embedded into

its surface such that one surface of the electrode is exposed to the interior of the reaction tube (10) and another surface is exposed to the exterior of the reaction tube. The surface of the electrode (25) on the exterior of the reaction tube is in contact with a conductive surface (26) connected to the positive electrode of the power supply (20) through an electrode wire (18). Variations of the arrangement depicted in Figure 63 are also contemplated by the present invention. For example, the electrode (25) may be in contact with the reaction solution (11) through the use of a small hole in the reaction tube (10); furthermore, the electrode wire (18) can be directly attached to the electrode wire (18), thereby eliminating the conductive surface (26).

As indicated in Figure 63, the electrode (25) is embedded in the bottom of a reaction tube (10) such that one or more reaction tubes may be set on the conductive surface (26). This conductive surface could serve as a negative electrode for multiple reaction tubes; such a surface with appropriate contacts could be applied through the use of metal foils (*e.g.*, copper or platinum, Aesar Johnson Matthey, Ward Hill, MA) in much the same way contacts are applied to circuit boards. Because such a surface contact would not be exposed to the reaction sample directly, less expensive metals, such as the copper could be used to make the electrical connections.

The above devices and methods are not limited to separation and concentration of positively charged oligonucleotides. As will be apparent to those skilled in the art, negatively charged reaction products may be separated from neutral or positively charged reactants using the above device and methods with the exception that capillary 13B is attached to the positive electrode of the power supply (20) and capillary 13A or alternatively, electrode 25, is attached to the negative electrode of the power supply (20).